What is claimed is:

1. An apparatus for removing selected metal ions from a plasma which comprises:

a container formed with a chamber for holding said plasma therein;

a substrate mounted in said chamber and exposed for contact with said selected metal ions, wherein said substrate is made of a crystalline compound and wherein said crystalline compound is interactive with said selected metal ions for diffusion of said metal ions into said substrate to create a liquid therewith; and

a receptacle for receiving said liquid as said liquid flows from said substrate.

2. An apparatus as recited in claim 1 wherein said crystalline compound is silica (SiO_2).

3. An apparatus as recited in claim 2 wherein said substrate in said chamber has a temperature and said substrate further comprises means for moving said substrate to selectively orient said substrate in said chamber to control said temperature thereof.

4. An apparatus as recited in claim 2 further comprising:

a means for evacuating said plasma from said chamber;

a means for introducing silane and oxygen into said chamber; and

a means for heating said substrate to cause a chemical vapor deposition (CVD) of silane and oxygen as silica on said substrate to augment said substrate after said plasma has been evacuated from said chamber.

5. An apparatus as recited in claim 2 wherein said substrate has a surface exposed to said plasma and said liquid is a liquified layer of said exposed surface.

6. An apparatus as recited in claim 2 wherein said plasma is a multi-species plasma having relatively light ions with a charge to mass ratio M_1, and relatively heavy ions with a charge to mass ratio M_2, and wherein said container is a plasma filter for directing ions M_1 and ions M_2 on separate trajectories in said container, and further wherein said apparatus further comprises:

a first said substrate for collecting said ions M_1; and
a second said substrate for collecting said ions M_2.

7. An apparatus as recited in claim 6 wherein said ions M_1 and said ions M_2 have a substantially same diffusion rate into respective said first and second substrates, and wherein said ions M_1 have a first deposition rate onto said first substrate and said ions M_2 have a second deposition rate onto said second substrate, and further wherein said first deposition rate is greater than said second deposition rate.

8. An apparatus as recited in claim 7 wherein said first deposition rate is greater than said diffusion rate and said second deposition rate is less than said diffusion rate.

9. An apparatus for removing metal ions from a plasma chamber which comprises:

an injector for introducing a plasma containing said metal ions into said chamber, wherein said plasma has a predetermined throughput , Γ;

a collector plate mounted in said chamber for holding a crystalline compound substrate thereon, wherein said crystalline compound is exposed in said chamber to interact with said plasma in accordance with the expression

$$\Gamma = nD/d + ndw/dt$$

where "n" is the solid density, "D" is the diffusion coefficient of metal atoms in the substrate glass, "d" is the thickness of a liquified surface area of said crystalline compound, and "w" is the thickness of a solid deposit on said liquified surface; and

a receptacle for receiving a liquid as said liquid flows from said substrate.

10. An apparatus as recited in claim 9 further comprising:

a means for evacuating said plasma from said chamber;

a means for introducing a reactant gas into said chamber; and

a means for heating said collector plate to cause a chemical vapor deposition (CVD) of said crystalline compound from said reactant gas onto said substrate to augment said crystalline compound substrate after said plasma has been evacuated from said chamber.

11. An apparatus as recited in claim 10 wherein said reactant gas includes silane and oxygen, and said crystalline compound is silica.

12. An apparatus as recited in claim 10 wherein said reactant gas is silicone alkoxide.

13. An apparatus as recited in claim 9 wherein said plasma is a multi-species plasma having relatively light ions with a charge to mass ratio M_1, and relatively heavy ions with a charge to mass ratio M_2, and wherein said plasma chamber is a plasma filter for directing ions M_1 and ions M_2 onto separate trajectories therein, and wherein said apparatus further comprises:

a first said substrate for collecting said ions M_1; and

a second said substrate for collecting said ions M_2.

14. An apparatus as recited in claim 13 wherein said ions M_1 and said ions M_2 have a substantially same diffusion term (nD/d) with respect to said first and second substrates, and wherein said ions M_1 have a first deposition term $(ndw/dt)_1$ onto said first substrate to create a solid deposit from said ions M_1 thereon, and said ions M_2 have a second deposition term $(ndw/dt)_2$ onto said second substrate, wherein said second deposition term is substantially equal to zero to preclude a solid deposit from said ions M_2 thereon.

15. An apparatus as recited in claim 9 wherein said plasma provides a heat input per unit area, P, and said substrate in said chamber has a temperature, T, and said substrate further comprises means for moving said substrate to selectively orient said substrate in said chamber to control said temperature thereof to satisfy the expression

$$\sigma \varepsilon T^4 = P$$

where σ is the Stephan Boltzman constant, and ε is emissivity.

16. A method for removing metal ions from a plasma chamber which comprises the steps of:

introducing a plasma containing said metal ions into said chamber, wherein said plasma has a predetermined throughput , Γ;

mounting a collector plate in said chamber for holding a crystalline compound substrate thereon, wherein said crystalline compound is exposed in said chamber to interact with said plasma in accordance with the expression

$$\Gamma = nD/d + ndw/dt$$

where "n" is the solid density, "D" is the diffusion coefficient of metal atoms in the substrate glass, "d" is the thickness of a liquified surface area of said crystalline compound, and "w" is the thickness of a solid deposit on said liquified surface; and

providing a receptacle for receiving a liquid as said liquid flows from said substrate.

17. A method as recited in claim 16 wherein said plasma provides a heat input per unit area, P, and said substrate in said chamber has a temperature, T, and wherein said method further comprises the step of moving said substrate to selectively orient said substrate in said chamber to control said temperature thereof to satisfy the expression

$$\sigma \varepsilon T^4 = P$$

where σ is the Stephan Boltzman constant, and ε is emissivity.

18. A method as recited in claim 16 further comprising the steps of:

a means for evacuating said plasma from said chamber;

evacuating said plasma from said chamber;

introducing a reactant gas into said chamber; and

heating said substrate to cause a chemical vapor deposition (CVD) of said reactant gas on said substrate as said crystalline compound to augment said substrate while said plasma is evacuated from said chamber.

19. A method as recited in claim 18 wherein said reactant gas includes silane and oxygen, and said crystalline compound is silica.

20. A method as recited in claim 19 wherein said plasma is a multi-species plasma having relatively light ions with a charge to mass ratio M_1, and relatively heavy ions with a charge to mass ratio M_2, and wherein said plasma chamber is a plasma filter for directing ions M_1 and ions M_2 onto separate trajectories therein, and wherein said method further comprises the steps of:

collecting said ions M_1 on a first said substrate; and

collecting said ions M_2 on a second said substrate wherein said ions M_1 and said ions M_2 have a substantially same diffusion term (nD/d) with respective said first and second substrates, and wherein said ions M_1 have a first deposition term $(ndw/dt)_1$ onto said first substrate to create a solid deposit from said ions M_1 thereon, and said ions M_2 have a second deposition term $(ndw/dt)_2$ onto said second substrate, wherein said second deposition term is substantially equal to zero to preclude a solid deposit from said ions M_2 thereon.